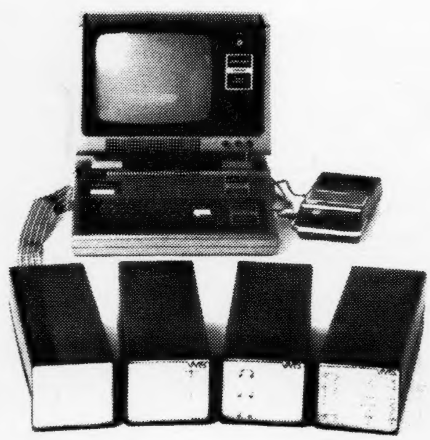
VIDEO
MODULAR
SYSTEMS

1440 SAN PABLO AVE. BERKELEY CA 94702 (415) 527-7700 TWX:910-366-7315

VIDEO
MODULAR
SYSTEMS



VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

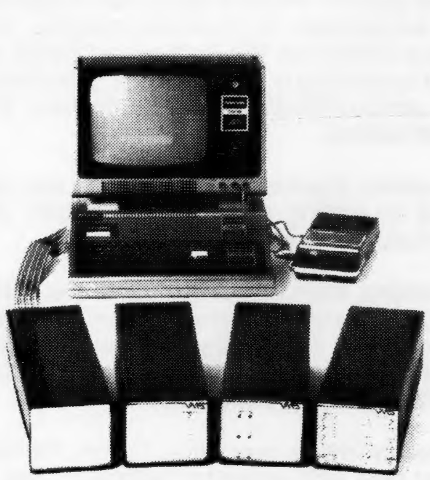
Attn: Bob Walker

VIDEO MODULAR SYSTEMS FEATURES

1. Compatible with TRS-80; PDP-11; Q or Unibus; S-100, Apple and GPIB
2. Full color genlock capable of locking to 3/4"; Betamax and VHS recorders
3. Four times color subcarrier sampling rates
4. Single module change converts system from NTSC to PAL
5. Built-in special test generator, teaches RGB color mixing
6. Full compatibility with S-100 computer bus and 8080, Z-80 software
7. Built-in dither generator for anti-aliasing (softens hard diagonal edges)
8. Modular construction allows almost infinite expansion
9. Up to sixteen levels of soft or hard edge digital keys or wipes
10. Full system update during vertical blanking interval
11. 4096 colors; 4 bits each R, G and B
12. Computer animation
13. Full color zoom, pan, tilt, squeeze and/or wobble; any form of distortion in real-time
14. Full optical bench effects

VIDEO MODULAR SYSTEMS
DESCRIPTION

VIDEO
MODULAR
SYSTEMS



VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

VIDEO MODULAR SYSTEMS DESCRIPTION

Video Modular Systems (VMS) represent a new approach to the design of video special effects equipment. This set of modules bears little resemblance to commercial video equipment now available on the market.

The best method of describing the system is to relate it to computer architecture. VMS is, in effect, a modular high-speed computer with a bit slice, pipeline architecture. Using the computer model, VMS takes on the following characteristics. The A/D converter is the system's input device for high-speed data. The 8 in-3 out switch is an analog multiplexer for high-speed I/O. The Firmware Interface Processor/Controller is the slow-speed bus buffer which interprets and formats data from the computer. The maps on the A/D and D/A modules serve as input and output registers for the Central Processing Unit (CPU). Both the Video Processing Unit (VPU) and the Multiplexer Key Matrix (MKM) act as part of the CPU. The MKM controls the data from its low-speed mode and does arithmetic operations in its high-speed mode. The VPU is the major Arithmetic and Logic Unit (ALU) for the CPU. The Pattern Generator is a complex real-time events counter and clock. It provides control over the analog and digital multiplexers on the high-speed bus, as well as special clocking when needed in the VPU.

Every signal in the VMS is based on the system clock. This master clock comes from the RGB encoder and is derived by multiplying the 3.58 color subcarrier by 4, or, in its absence, from its own internal crystal oscillator. The RGB encoder serves as a data translator and formatter, translating the high-speed bus signals back to television signals and adds sync pulses, etcetera. The D/A converter is the final digital buffer; it translates the data to a form acceptable to the RGB encoder. Frame buffers serve as cash memory for the high-speed data, thus allowing the data to be stored and moved, as well as re-formatted. The RGB Decoder is a special data formatter. It allows for individual channel processing of color data.

VMS utilizes a unique concept which allows it to process the high-speed video signal in real-time (Note: Real-time actually refers to a minimal delay—nothing happens instantly). By using the incoming data as address on a number of memory locations and repeating the process with the output of the memory a number of times, various relationships can be set up in the memory (see tables) and complex relationships can be set up between signals. The use of multiple signals as address on the same memory expands this concept and allows all possible combinations to be achieved. With this method in operation, the user need not know the content of the signal in order to process it. One way of understanding the nature of VMS is to consider the logic base of the system. It is based on whatever the video value is during the current sampling period, not on ones or zeroes or positive and negative values. This unique floating number base allows the system to act on video in real-time.

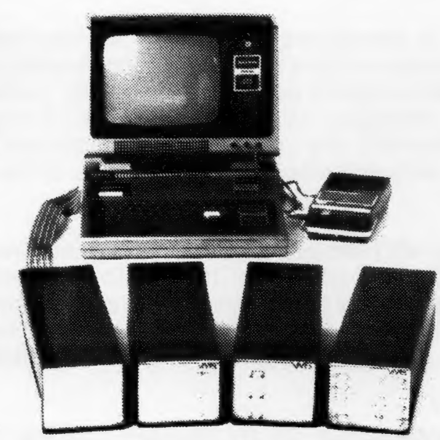
With this unusual architecture, the VMS can accomplish complex operations in real-time while conventional computers would take hours to perform the same calculations (i.e. two dimensional fourier transforms). All video effects now considered standard in the industry are possible within the confines of this system. Certain effects which previously could only be done on expensive picture analysis computer systems can now be handled by VMS. For example, an expanded system can accomplish multiple chromakeys, selecting one or more out of 4096 distinct colors. Sixteen level keys are simple on the high-speed mode of the multiplexer. Color convergence error in cameras can be corrected by shifting color fields in the buffers. The pattern generators yield an infinite number of wipe patterns which can be moved at any rate desired. Almost all film optical bench effects can be accomplished by the use of the buffers.

A sixteen level colorizer is the most primitive application of the system. Frame storage permits low resolution time base correction. "Telistrator" type effects are possible by adding a light pen or tablet. Action figures may be outlined and tracked by comparing past and current picture fields.

All the effects in the system can be changed every vertical blanking interval. This means the VMS can achieve images which have the quality of complex post-production editing by changing the control sequence to the modules at a rapid rate, a feature which was hitherto unavailable. This ability to store the relatively small command sequence in the host computer leads to greater control over the production process. Effects sequences can be edited and timings modified during rehearsals and production.

Video is image over time with real-time feedback, while film is merely image over time. In this framework, video more closely resembles music than film. Music is sound over time with real-time feedback. The Video Modular System has been designed, in part, to explore this real-time compositional mode, made possible with the editing facilities of the computer.

VIDEO
MODULAR
SYSTEMS



VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

COLORIZER CONFIGURATION

One of the basic features of the VMS is a simple sixteen level-4096 color colorizer. The colorizer utilizes the four most basic VMS modules—the A/D, D/A RGB encoder and the computer interface. When using these modules as a colorizer for a single black and white video source (independent sources can be used for the RGB inputs if desired), they are configured as described below.

The video is connected to the genlock-in on the RGB encoder and the R, G and B inputs of the A/D module. The unmapped outputs of the A/D are connected to the mapped inputs on the D/A (only one map is required to operate in this configuration). D/A outputs are input into the RGB inputs of the encoder. The clock outputs are connected to A/D and D/A clock inputs. The computer interface is connected to the control input of the D/A module. Please note that only the D/A is fed information from the computer in this configuration. The computer interface can be replaced by parallel line outputs. This replacement is not supported by our software, however, and is not suggested.

The colorizer theory of operation is simple. It consists of loading the R, G and B channel memory maps with data. Since the incoming video is used to address the memory location (i.e. level Ø addresses memory space Ø; level 3, memory space 3, etc.), filling memory locations Ø through 15 with values Ø through 15 in all three channels results in a sixteen level black and white display. In order to colorize the picture memory, values must be changed.

The colorizer program fills the computer screen with the display in Figure #1. Rows Ø through 15 (bottom to top) are filled with sixteen successive columns of R, G and B's, representing values Ø through 15 (left to right). The final column positions, Ø through 15, represent the value selected for R, G and B in that row. If two primary colors have the same value, a " + " is present to represent the overstrike.

Values are selected by positioning the cursor over the appropriate R, G or B and hitting the "*" key. This replaces the R, G or B which then appears in the appropriate column of the last sixteen positions. Activating the test generator in the A/D box will produce, on the color monitor, the display in Figure #2. The test display sections the monitor into four vertical columns, from left to right, Red, Green, Blue and Mixed Color; and sixteen horizontal rows, from bottom to top, Ø to 15. This display is the analog of the computer terminal screen.

It allows the individual controlling the system to see the results of map changes relative to color. When modules, such as the 8 input/ 3 output switch and the pattern generator, are added to the system, the test display can be time shared with the video input in a number of ways.

The actual information required to load all three colorizer maps is twenty-four bytes of memory. This means that hundreds of different settings can be stored by even the simplest of home computers.

There are many applications for the VMS colorizer configuration. In laboratories, the VMS colorizer can be used to accent changes in experimental data. A change in physiological signals from an experimental subject can change the color of the subject on the screen. Multiple data signals can be color coded. Subjects in biofeedback experiments can see results of their efforts by changing screen color. Medical x-rays, thermography and sonograph displays can be colorized and, if desired, the colorization can interact with other biotelemetry. This ability to change colorization from telemetry enables much more data to be displayed and analyzed on a single monitor.

Educational testing can be made more interesting and rewarding with the use of color coding answer responses. The applications in industry are similar to those in medicine and science. Changes in the functioning of industrial machinery can be easily monitored if color coding is used to indicate changes in temperature, speed and lubrication of machinery. Those observing large factories on monitor displays can instantly see malfunctions and problems in a variety of situations. Similarly, a bank of security monitors can show an intrusion by displaying the area violated in red.

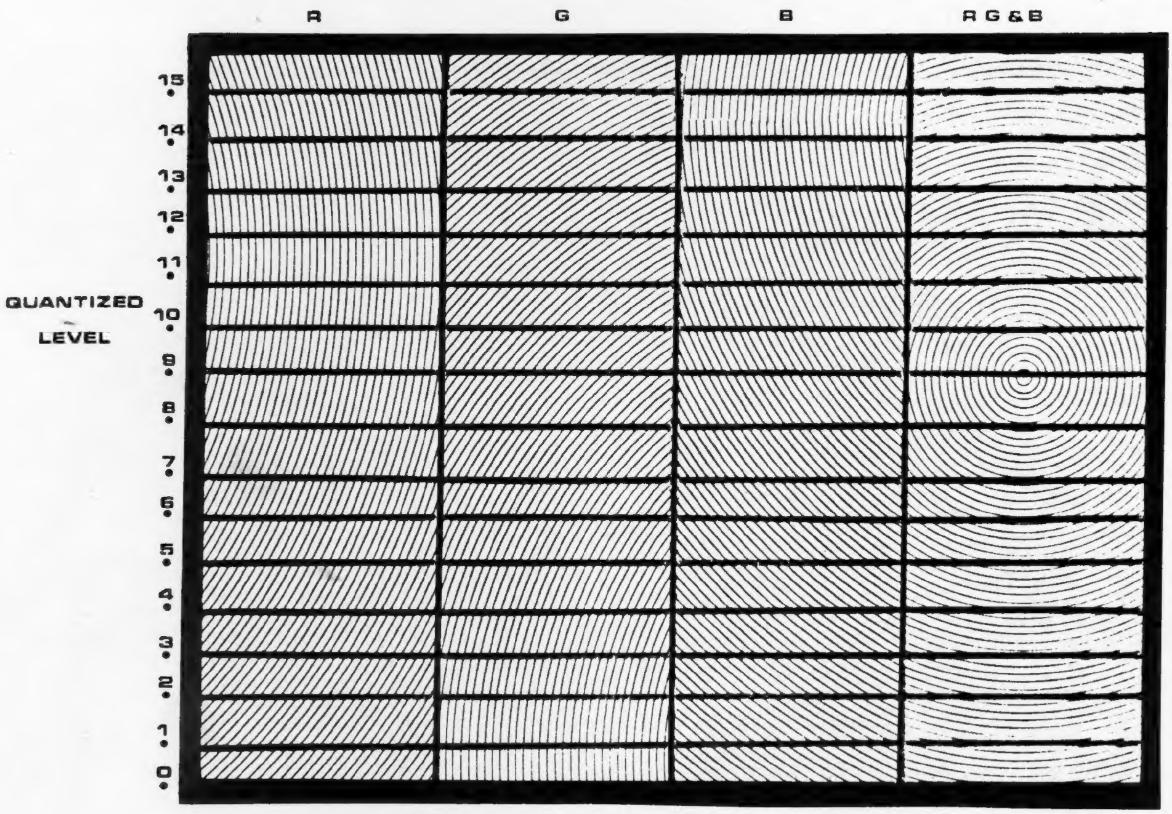
The possible applications of the VMS in the fields of video and photographic art are obvious from the many examples of results using more primitive devices. The major advantage of the VMS from an artistic standpoint is that the computer is able to compose and edit material on the field by field basis.

Thus far, we have discussed the most fundamental uses of the Video Modular System. As additional modules are incorporated, the potential power of the system grows exponentially.

FIGURE #1 VMS COLOR CONFIGURATION

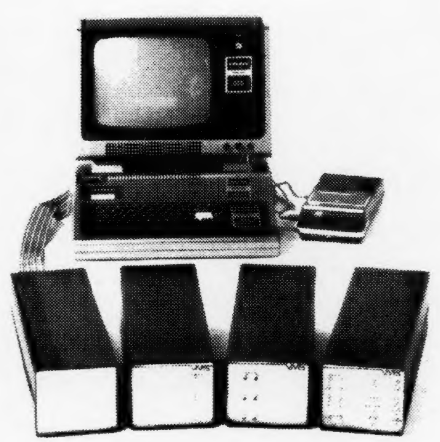
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF
RRRRRRRRRRRRRRRR	GGGGGGGGGGGGGGGG	BBBBBBBBBBBBBBBB	0123456789ABCDEF

FIGURE #2 VMS COLOR CONFIGURATION



ANALOG TO DIGITAL (A/D) CONVERTER (MAPPED)

VIDEO MODULAR SYSTEMS



VMS CONFIGURATION
(Shown with TRS-80 Computer)

VMS

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

ANALOG TO DIGITAL (A/D) CONVERTER (MAPPED)

The VMS A/D Converter takes advantage of the latest in LSI chip technology for a 4 bit, 16 level, 3 channel A/D converter. The unit is capable of running at speeds far greater than the 4x subcarrier which is the system's normal internal clock speed.

The unit takes in a composite video signal, strips sync on three video inputs (R, G and B) and may either be clocked by the system clock or free-run.

The output of the A/D converter addresses a memory map. The read address for the memory comes from the video; the write address and data comes from the computer during vertical blanking interval. This allows any luminancevalue to be reassigned any other value. It allows complex outlining and other colorization functions when used on a single or multiple black and white signal. Complex reassignment and color manipulation can also be performed on a decoded color signal. Both the mapped and unmapped digital signals are available and both can be used with other VMS modules. It should be noted that while the A/D module was specifically designed for video, it can be used in a number of ways with audio frequency signals.

PRELIMINARY SPECIFICATIONS:

Inputs:	R., G, B in (3), 1 volt peak-to-peak composite or non-composite video into 75Ω $\pm$2dB, 0-4.5 MHz clock in: 14.318 MHz typ., 20 MHz max, ((2) 74S TTL Loads) control port: 8 bit data bus, 12 bit address bus.
Outputs:	Digital Video (Out) 4 bits x 3 channels (R, G, B) will drive 10 TTL loads.
Mechanical:	4.94" x 5.68" x 18"
Power:	115/230 VAC 50/60Hz, 60W (max).

VIDEO MODULAR SYSTEMS

VMS CONFIGURATION
(Shown with TRS-80 Computer)

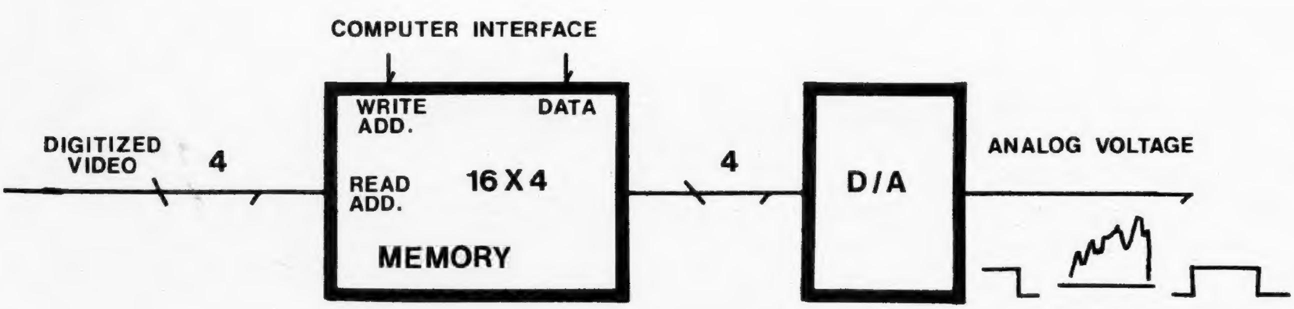
1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

D/A CONVERTER (MAPPED)

The VMS Digital to Analog (D/A) Converter Module is used to convert the digital 4-bit signal back to an analog voltage for the RGB encoder. In the same manner that the A/D converter has memory on its output, the D/A converter has a memory map on its input. When using the A/D, D/A and encoder as a colorizer, only one map is required. The theory of map operation is the same in both the case of the A/D and D/A converter. Incoming data is used as read address on the memory. For example, a value of five is translated into whatever data is in memory location five. The data in the memory is provided by the computer during the previous picture scan to the interface and is loaded into the module during vertical blanking interval (not scan). As mentioned earlier, either the A/D or D/A map is ignored during colorizer application.

FIGURE # 1



PRELIMINARY SPECIFICATIONS:

Inputs:	Digital Video (mapped) in 4 bits x 3 channels (R, G, B), 150 Ω termination
	clock in - 14.318 MHz typ, 20 MHz max, 150 Ω termination PNP inputs
	control port - 8 bit data bus, 12 bit address bus
Outputs:	3 channels (R, G, B) - each 1 volt peak-to-peak non-composite into 75 Ω , $\pm$LdB 0-4.5MHz. accurate to 1/2 LSB
Mechanical:	4.94" x 5.68" x 18"
Power:	115/230 VAC 50/60Hz, 20 W max.

VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

RGB ENCODER MODULE

The VMS RGB Encoder is designed to take R, G and B signals at standard video levels or positive going TTL Logic, and provide an NTSC signal output. The module is also designed as a genlock to provide synchronization with the other modules in the VMS system. In order to accomplish this, the device has all the standard video synchronization outputs as well as a clock for the VMS System, running at 4x color subcarrier.

If the unit has subcarrier coming into the genlock input, then the clock pulse and color signal. If no subcarrier is present at the genlock input, color and clock pulse are generated internally by a crystal.

Two optional plug-in boards exist for this unit. One is a color bar and test pattern generator; the other option is an internal sync generator. When the sync generator option is activated, non-synchronous color signals are provided with synchronous color output. The RGB encoder module may be used as an encoder for digital frame and field store units such as those used in computers, as well as in conjunction with the VMS digital video synthesizer equipment. The test signal generator can be combined with the VMS vector adaptor display module to provide a basis for camera and VTR alignment.

Inherent in the RGB encoder TTL level sync outputs is its ability, without the use of extra circuitry, to produce video sync information in a computer-readable form. The video sync pulses can then be used by the computer for information and interrupt driving.

PRELIMINARY SPECIFICATIONS:

Inputs: 1 volt peak-to-peak composite reference video R, G, B inputs (3) - each 0-1 volt (75 Ω)

Outputs: Composite video out 1 volt peak-to-peak into 75 Ω (Output is locked to reference video input; sync is of same quality as reference video input)

composite sync out, 4V peak-to-peak into 75 Ω

composite blanking out, 4 V peak-to-peak into 75 Ω

Outputs: burst flag out, 4 V peak-to-peak into 75Ω

subcarrier out, 2 V peak-to-peak into 75Ω

horizontal drive out, 4 V peak-to-peak into 75Ω
3 TTL outputs of HD at rear panel (10 TTL loads each)

vertical drive out, 4 V peak-to-peak into 75Ω
3 TTL outputs of VD at rear panel (10TTL loads each)

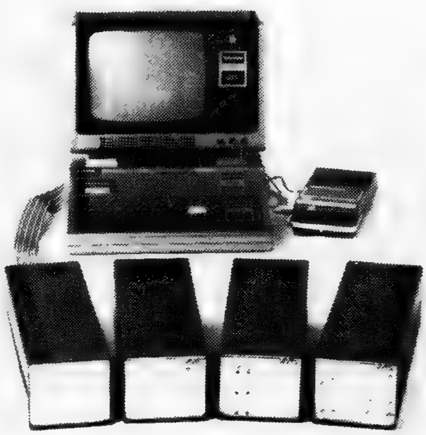
clock out 14.318 MHz clock - locked to reference subcarrier, 1 output (front panel) - 10 TTL loads
12 outputs (rear panel) - 10 TTL loads each

Internal color bar test generator (switch on/off)

Mechanical: 4.94" x 5.68 x 18"

Power: 115/230 VAC, 50/60 Hz, 20 W max.

VIDEO
MODULAR
SYSTEMS



VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

8 INPUT/3 OUTPUT MATRIX SWITCH

The applications of this module are too numerous to be adequately described on this sheet. In its simplest form, the unit functions as a basic vertical interval video switcher, letting any one of eight inputs to be fed to the R, G or B input of the VMS Digital Video Colorizer. Since the unit will switch either composite or non-composite video signals, it may also be used for display and general signal switching. The device provides computer-controlled programs which permit the use of various video sources and monitors, in a manner similar to multiple slide projector and multi-media presentations.

Audio signals can also be entered at proper video levels. The first of these inputs contains a microphone preamplifier which allows voice to be entered without any special equipment other than a microphone. Because the computer inputs can be mixed with higher speed digital signals, they can also be used in conjunction with the A/D converter and pattern generator as a multiple level key or wipe generator. The complexity of these keys and wipes are dependent upon the number of the eight input-three output switching modules present in a particular system.

A significant feature of this module is its computer's ability to change the program during vertical blanking interval. A very small computer with our simple software can program real-time cutting. The result would appear to be the product of a very complex editing job.

The software provided allows easy programming of the switching functions and overall timing changes. Programs can be synchronized with audio inputs, and complex mathematical relationships between selected picture inputs can be formulated. This particular feature enhances the capabilities of the VMS Digital Video Synthesizer. Until now these options were only available in devices costing ten times the price of this configured system.

PRELIMINARY SPECIFICATIONS:

Inputs: 8 selectable inputs (loop throughs)

a) 1 is microphone level, audio bandwidth (20 Hz-20KHz) / composite or non-composite video, 1V, peak-to-peak 0-4.5 MHz

b) 5 are ± 10V. level, audio bandwidth (20 KHz) / composite or non-composite video, 1V peak-to-peak 0-4.5 MHz

c) 2 are 0-5 V TTL level, video bandwidth/composite or noncomposite video, 0-4.5 MHz.

Each of the eight selected input channels has 6 bits of bias adjustment (64 levels of bias ± full scale), changeable every field (1/60 sec.)

Each of the eight selected channels has 6 bits of gain adjustment (2 x full scale to 1/32 full scale), changeable every field (1/60 sec.)

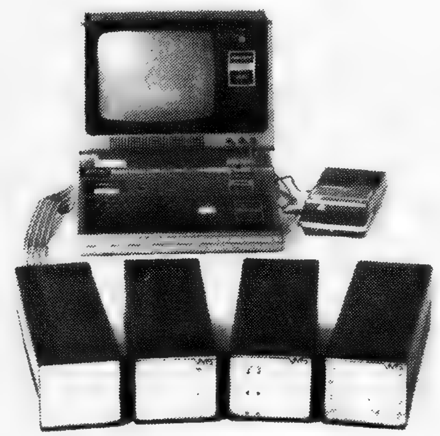
Control Port: 8 bits data bus, 12 bit address bus

Output: 3 output section can select any combinations of the 8 (gained and biased) inputs; each output 1V peak-to-peak into 75Ω
Input and output selects are settable at video rates (to 5MHz max.)

Mechanical: 4.94" x 5.68" x 18"

Power: 1 15/230 VAC, 50/60 Hz, 20W max.

VIDEO
MODULAR
SYSTEMS



VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

FIRMWARE INTERFACE PROCESSOR/CONTROLLER

The VMS Firmware Interface Processor/Controller (FIP/C) occupies a double size module and contains a full S-100 bus, including Z-80 type microprocessor operating at 4.0 MHz, in addition to our special purpose bus.

The operation principle is simple. The appropriate lead goes to the microprocessor adaptors toward S-100, TRS-80, Apple, LSI-11-Q bus or Unibus and appears as memory to the host computer. The computer is sent a not-vertical blanking signal which allows it to load the interface while the field is being written. During vertical blanking interval, the interface loads the VMS Digital Synthesizer from its own memory. The interface microprocessor also polls the devices to which it is connected, to determine their address and function. The interface contains its own program ROMs which may be changed as the unit is updated. All of the basic programs such as the colorizer program can be downloaded to the host computer. The FIP/C is a standard S-100 computer and can be used to incorporate standard peripherals into the computer. Devices such as the Golemics, Inc.'s 256 channel A/D converter will be available with joysticks, sliders, knobs and the software to integrate these hand controls into the system.

The interface processor/controller will handle sixteen modules. Multiple interfaces may be used in a multiprocessor configuration. Please note that the color vector display and the encoder need no computer hook-up.

Keyboards, communications interfaces and modems will be available as options, as well as special purpose ROM programs for video processing and effects for those not intending to use the unit either remote or direct with a host processor.

VIDEO MODULAR SYSTEMS

VMS CONFIGURATION
(Shown with TRS-80 Computer)

VMS

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

RGB DECODER MODULE

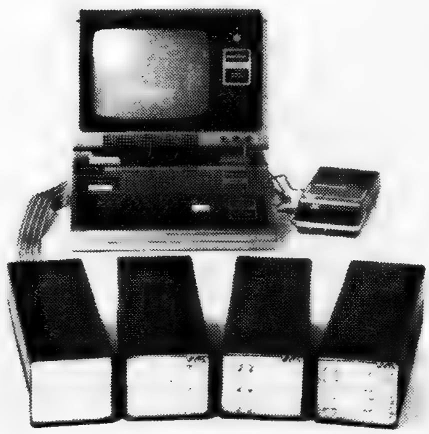
The VMS-RGB Decoder Module takes a composite color video signal and breaks it down into separate red, green and blue non-composite signals. The output of the decoder is suitable for input into the A/D converter. With this configuration, a single color video source is treated as R, G and B components of 4-bit resolution, making 12-bits of overall signal processing.

When the decoder is used in front of the A/D converter in a colorizer configuration, the system acts as a color correction and change processor. Colors in the picture can now be changed individually. For instance, a red dress in the picture can be made blue; problems in skin tone may be corrected without changing the other colors in the picture. Multiple color signal processing is possible when additional RGB Decoders are incorporated into a VMS configuration and in that case, however, it is advisable to add the appropriate number of multiplexer boards.

When used in conjunction with the video processing module, the decoder helps generate very precise chromakeys (one or more out of 4,096 colors). The stringent lighting requirements usually associated with the chromakey effect are no longer necessary with the use of this device.

VIDEO PROCESSING UNIT-
VIDEO COMBINATORIAL PROCESSOR

VIDEO
MODULAR
SYSTEMS



VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

VIDEO PROCESSING UNIT-
VIDEO COMBINATORIAL PROCESSOR

The Video Processing Unit (VPU) extends the memory mapping concept used in the A/D and D/A modules, giving the system extended combinatorial power.

The mapping concept used in VMS is a relatively simple one (Figure #1). Real-time data (i.e. video) is used to provide an address for a memory cell. For example, a value of level 5 coming in to the system displays the data located in memory location 5. The data in the memory is provided by the picture scan and loaded into the memory during the next vertical blanking interval.

In this way, any other value may be substituted and the substitute value can be changed every vertical blanking interval (once per field). This real-time mapping function results in the production of effects comparable to those hitherto achieved only in post production editing.

The VPU expands the simple map function by increasing the size and number of the maps through the use of a 256 x 4 bit memory map (Figure #2). Two 4-bit signals address the map. One signal acts as the lsb and the other acts as the msb (least and most significant bits, respectively), thus substitution for every possible combination of the two signals is possible (Map A, Figure #2). The same procedure is carried out with the inputs to a second memory space of the same size (Map B, Figure #2). The ALU's on the outputs allow complementing (inverting the signal) and other arithmetic and Boolean functions to be implemented. The two 4-bit outputs of the ALU's are then used as address on a third map (Map C, Figure #2). This allows any combination of substitutions to be made, as well as complex mathematical relationships to be set up between the four inputs. If the pattern generator is used as an input, wipes as well as keys may be executed. When stored fields are compared with current fields, complex image processing can be done in real-time.

The VPU is capable of executing most mathematical functions between its inputs in real-time. Until the introduction of the VMS, this could only be achieved with complex programming in stored time.

With the addition of the VPU, the VMS begins to reveal its true nature. The system is a pipeline computer, handling video in real-time. This is achieved because the system does not attempt to analyze the video passing through it, but performs function upon it. The video in the system takes on the role of the logic base for the processor. This logic base is not either positive or negative but has as its base whatever the video signal happens to be at the particular sampling period.

FIGURE #1

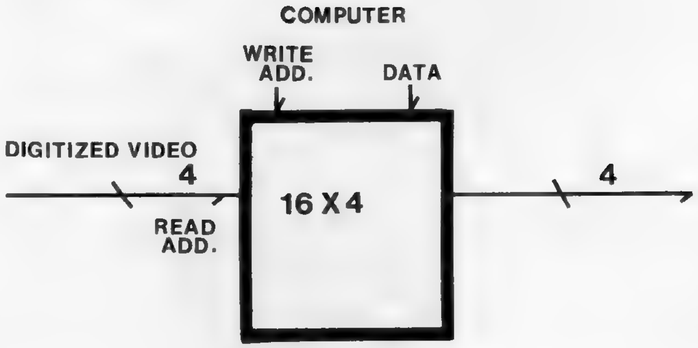
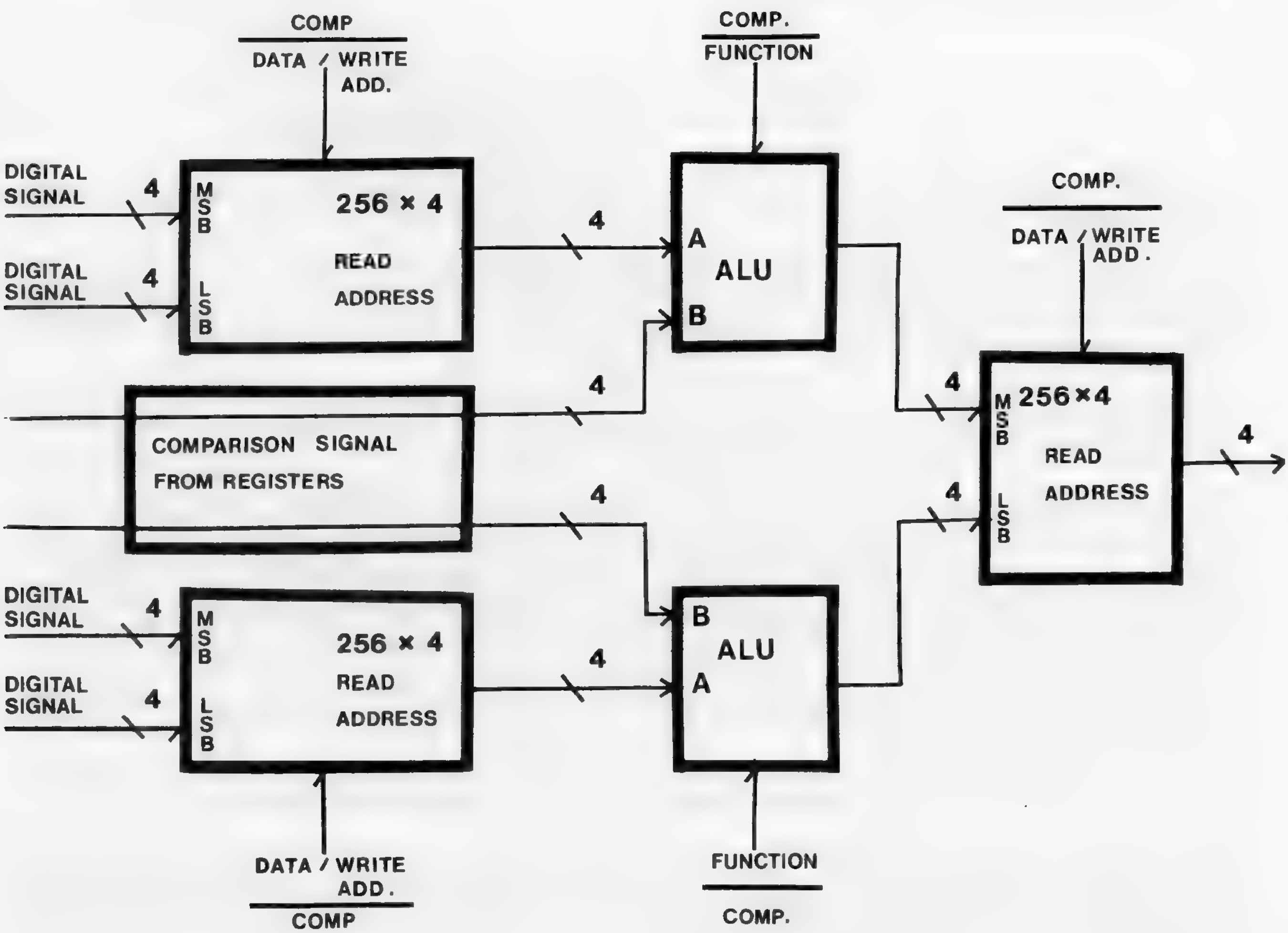


FIGURE # 2 VPU (1 of 3 channels)



VIDEO MODULAR SYSTEMS

VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

MULTIPLEXER KEY MATRIX (MKM)

The MKM system has two basic operating modes, and while the theory of operation is the same in both, the visual effects are dramatically different. The unit is a 16 input-4 output, 4 bit, 3 channel (RGB) matrix switch with a 16x4 map on the switch selector inputs. The two modes are program selected. Switching inputs either come from the computer (slow speed) during vertical blanking interval, or from a real-time signal (high speed) such as digitized video of the pattern generator.

When the MKM is in the slow speed mode, it eliminates the need to rearrange the position of the modules. This allows all digital patching to be done by the computer and greatly expands the capabilities of the system, since the device may be rearranged during vertical blanking interval. Please note that the multiplexer is limited to sixteen inputs, although these units may be ganged together to make almost any number of inputs and outputs.

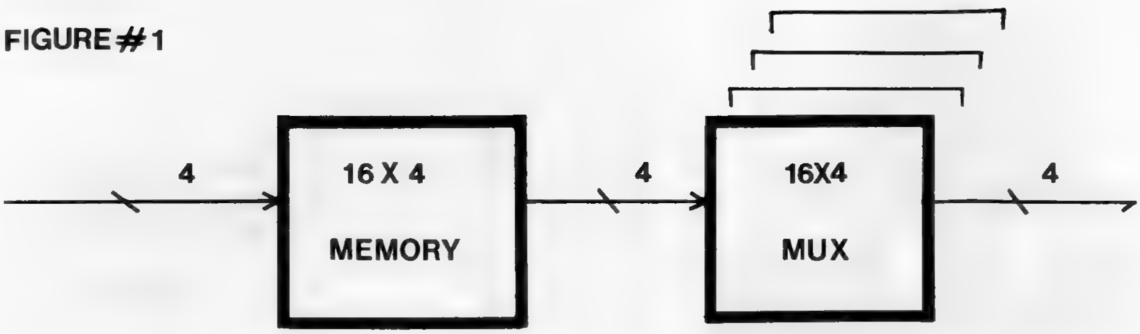
Implementation of the high speed mode produces a broad based, multi-level digital video keyer with up to sixteen levels. If the input to the device is the output of the VPU, soft edges keys are also possible. If the input is from the RGB decoder, then complex chromakeys can be implemented.

The key function is implemented by setting the input map so that it contains only two values (see Figure #1). One value signifies the lower range of the grey scale and the other represents the upper range. We now have a standard video key, in which the input to the map determines the shape of the key and the two selected values in the map indicate the video signal inside and outside the key. If the maps contain more than one value, the number of levels in the key is extended. If the data to the map is a mix of the data being switched, soft edged and similar effects are the result.

The MKM's use in combining stored time (frame store) video images with current (real-time) images is its most important function. By continually recombining past and current frames, a high level of image filtering can be achieved. This is only possible with the computer controller patch capability of the MKM.

The MKM plays a major role in the Video Modular Systems' expansibility. Its multi-level architecture, combined with the ability to run multiple interfaces in parallel, allows almost infinite system expansion.

FIGURE #1



PRELIMINARY SPECIFICATIONS:

Inputs:	16 high speed channels x 4 bits in, (150Ω system termination)
Outputs:	4 high speed channels x 4 bits out, (150Ω system termination)
Control Port:	8 bit data bus, 12 bit address bus
Mechanical:	4.94" x 5.68" x 18"
Power:	115/230 VAC, 50/60 Hz 50 W max.

PATTERN GENERATOR MODULE

VIDEO MODULAR SYSTEMS

VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

PATTERN GENERATOR MODULE

The VMS Pattern Generator Module consists of two phase accumulator type digital frequency synthesizers and an arithmetic logic unit (ALU.). During normal operation, one synthesizer generates a horizontal pattern while the other generates vertical patterns. The ALU generates a logical or arithmetic function of the two. These three outputs are available in digital and analog form, and are valuable for pattern and wipe generation.

The pattern generator can be used in conjunction with the 8 in- 3 out switching module to create wipes between input channels. The outputs can be mixed with other signals in the VPUs or be used to switch channels on the sixteen input mux.

Almost any shape or pattern can be produced by the pattern generator. By increasing frequency, the pattern can be multiplied, and by offsetting the frequency slightly, it can be moved through the picture at a controlled rate. Because VMS is divided in R, G and B channels, one or more pattern generators can be used to window different video signals in various colors. This windowing effect leads to many interesting possibilities when used to isolate important information in the picture.

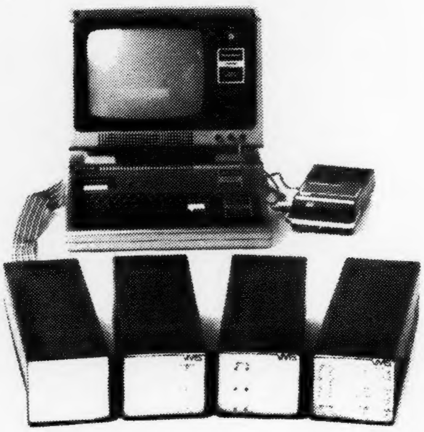
In an experiment, the color of the window in a close-up picture of a subject can be changed according to the data being monitored. Pattern generators can also be used to generate real-time moving backgrounds for animations done in the frame buffers. Audio synchronization of pattern generator outputs can be achieved by mixing them with audio signals in the VPU.

Synchronization of audio and video has been possible for some time. But with the VMS modules under computer control, complex relationships, never before possible, are obtainable. The analog outputs of the pattern generator can be used to make video timings available to audio synthesizers.

PRELIMINARY SPECIFICATIONS:

Inputs:	Clock-DC to 20 MHz (system video clock freq = 14.318 MHz) Resetable up to 20 MHz (normally reset at horizontal or vertical video rates)
Outputs:	1024 segment pattern 16 possible levels/segment pattern size adjustable in 70 nsec pixel increments resolution of one horizontal pixel, 70 nsec
Mechanical:	4.94" x 5.68" x 18"
Power:	115/230 VAC 50/60 Hz 50 W (max)

VIDEO
MODULAR
SYSTEMS



VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

FRAME BUFFER

The VMS Frame Buffer module is a double-size unit, housing two S-100 type backplanes. The system requires VMS control and any type of S-100 memory on 32K boards, with memory speed of better than 500 nanoseconds. The VMS Frame Buffer module control electronics contain special digital dither electronics, which allow the system to vibrate the pixels and smooth out the picture, eliminating stairstep and aliasing phenomenon on diagonal straight edges. Thus, the picture is ensured to have a smooth, rather than digital, appearance.

The VMS Frame Buffer serves two major functions.

It is a video storage device. The Frame Buffer, as its name implies, stores video on a field basis, allowing the system to process stored time events with each other and with real-time events. Functions such as zooming, panning, and image distortion can be accomplished with the module mathematically processing the input to both the read and write memory counters. The VMS Frame Buffer is comprised of a matrix of 390 horizontal dots by 600 vertical dots per field. (Note: For NTSC video, only 500 of the 600 vertical dots are used. The added resolution is for PAL systems which also require a PAL encoder.)

The second major function of the VMS Frame Buffer module is the generation of computer graphics. The device receives information either from the computer or as real-time signal under program control. The number of frame buffers configured in the system determines the permutations of graphic data, real-time signals and various effects possible between them.

The buffers are fed through the computer interface but a number of options are available for control of the intelligent interface. S-100 peripheral devices include A/D converter boards with knobs and joysticks, touch-sensitive tablets, digitizer tablet, character generators, and keyboards. VMS provides a programmable genlock character generator, a 256 channel A/D converter, and a touch tablet as support options.

The ability to perform all the complex video routing and effects with hooks for control from BASIC is presently available.

VMS is currently engaged in work on a major software development project which is expected to yield a special graphics control language. We estimate completion of this language by the end of 1979. It should be noted that the software development has been in progress for four years and predates the actual equipment development. We consider software support to be an ongoing process.

COLOR VECTOR DISPLAY ADAPTOR

VIDEO
MODULAR
SYSTEMS

VMS CONFIGURATION
(Shown with TRS-80 Computer)

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker

COLOR VECTOR DISPLAY ADAPTOR

The VMS Vector Display Adaptor is made for use with any oscilliscope which has a speed of 500 KHZ or better and an external trigger. The device generates standard vector (clock face) display of color, as used in color video equipment calibration in broadcast facilities. The adaptor is one-sixth the price of "traditional" vectorscopes. So, for the first time, smaller studios can have this type of display without the customary expense.

The device can also switch between vector display and stable video waveforms at vertical or horizontal speeds. This makes professional-calibre test equipment available at a fraction of the usual price.

The vector adaption module is designed to take a number of plug-in expansions. The first of these options will be the RGB decoder board which will allow chromakey to be added to video production facilities with minimal cost. The vector adaptor becomes particularly useful when combined with the VMS encoder-genlock. This combination is enhanced if the encoder is equipped with optional color bar and test pattern generator.

The vector adaptor takes advantage of the latest in solid-state technology to make it possible for an oscilliscope to enter the realm of broadcast studio-type signal evaluation and display. The module takes in NTSC or RS170 composite video sync (PAL version will be available shortly) and sends out the X and Y signals needed to drive a standard oscilliscope. A rotation knob for proper positioning of the display and a set of overlays which will fit most oscilliscope faceplates are provided.

PRELIMINARY SPECIFICATIONS:

	Inputs:	1 Volt peak-to-peak composite video 1 Volt peak-to-peak external subcarrier
	Outputs:	x out, 6 V peak-to-peak y out, 2 V peak-to-peak X' out, 10 V peak-to-peak, ramp Y' out, 1 V peak-to-peak composite video, clamped to Gnd during ramp, to +10 V during retrace (to blank screen)
	Controls:	rotation internal/external subcarrier switch view vector display/view video waveform switch
	Mechanical:	4.94" x 5.68" x 18"
	Power:	115/230 VAC, 50/60Hz, 20 W max.

PRICE LIST

VIDEO
MODULAR
SYSTEMS

ANALOG TO DIGITAL CONVERTER	$1100.00
DIGITAL TO ANALOG CONVERTER	$ 650.00
R G B ENCODER	$ 695.00
VECTOR ADAPTOR	$ 495.00

1440 San Pablo Ave.
Berkeley, CA. 94702
Tel: (415) 527-7700

Attn: Bob Walker